

## DRAWINGS ATTACHED

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## (54) IMPROVEMENTS RELATING TO SYRINGES SUCH AS HYPODERMIC SYRINGES

(71) I, ALLAN GEOFFREY WIGGINS, a British Subject of 36 Wilton Road, Sparkhill, Birmingham 11, in the county of Warwick, do hereby declare the invention for which I pray that a Patent may be granted to me and the method by which it is to be performed to be particularly described in and by the following statement:—

This invention relates to syringes such as hypodermic syringes used for injecting liquid into patients and being of the kind comprising a cylinder part and a piston part and such a syringe is referred to herein as being "a syringe of the kind specified".

It is essential that patients suffering some illnesses receive injections at regular intervals and this is the case with diabetics who require daily injections which are usually self-injected by the patient in order to avoid undue inconvenience and such patients are herein referred to as self-injecting patients. Various forms of syringes are available and can be used by self-injecting patients having good sight because the cylinders of the syringes are made of transparent material and are graduated in doses or marks.

In one said known syringe which is entirely disposable after a single use the piston part comprises a rod made of plastics material of cruciform cross-sectional shape having a piston head at one end and a knob at the other end and in another such known but re-usable syringe the piston part comprises a metal piston rod of circular cross-sectional shape having a piston head at one end and a knob at the other end and passes through a closure cap at the rear end of the cylinder part and disposed in the cap is a U-shaped spring clip which is retained against axial movement but can rotate relative to said cap and the clip straddles the rod and exerts a frictional grip thereon to tend to retain the piston part in any position longitudinally of the cylinder part whilst permitting rotation of the piston part relative to the cylinder part.

In these known syringes the doses or marks of liquids are gauged visually and, therefore, are quite unsuitable for use by blind self-injecting patients.

Furthermore, a syringe of the kind specified has been proposed in U.K. Patent Specification No. 847914 in which the cylinder and piston parts are provided with graduation means comprising interengageable formations but which are determinable by observation and thus the syringe is of no real value to a blind patient.

It is an object of the present invention to provide a syringe or a part therefor which can be used by a blind self-injecting patient to draw into the syringe the correct doses.

According to the present invention a syringe of the kind hereinbefore specified or a part therefor is provided with tangible graduation means of which, at least when the syringe is in a partly or fully extended condition, a number is or are exposed which correspond to a dose of fluid drawn into or to be expelled from the syringe to enable a blind patient manually to assess the correct dose by counting the number of tangible exposed graduations.

In order further to assist the patient audible graduation means are incorporated in the syringe or a part therefor.

Preferably the tangible graduation means are provided by a plurality of notches and projections which are spaced apart longitudinally of the syringe and correspond to doses.

It is found most convenient to provide the notches and projections on the piston part so that they can be exposed externally of and relative to the cylinder part to gauge the correct dose by the patient touching and thus feeling the number of exposed notches or projections.

Conveniently a spring non-prohibitively co-operates with the notches and projections to afford the audible graduation means in the nature of a click-stop arrangement.

Various forms of the invention will now be

more particularly described with reference to the accompanying drawings in which

FIGURE 1 illustrates a hypodermic syringe in a disassembled condition and in which the notches or graduations are incorporated in the piston part,

FIGURE 2 is a sectional view of Figure 1 on the lines 2—2 thereof on an enlarged scale,

FIGURE 3 is a sectional view of a part of Figure 2 on the lines 3—3 thereof,

FIGURE 4 is an enlarged fragmentary sectional view showing the notches and projections and a spring in engagement therewith,

FIGURE 5 is a cross-sectional view on an enlarged scale of a piston rod,

FIGURE 6 is a view of a spring on the same scale as Figure 5,

FIGURE 7 is a view of a further form of piston part,

FIGURE 8 is a view of a further form of piston part,

FIGURE 9 is a perspective view of a still further form of piston part,

FIGURE 10 is a sectional view of another form of hypodermic syringe and

FIGURE 11 is a view of a still further form of hypodermic syringe in which the notches and projections are provided on the cylinder part.

Where convenient similar reference numerals will be used throughout the several views to denote corresponding parts.

Referring to Figures 1 to 6 the hypodermic syringe comprises a cylinder part 20 and a piston part 22 and the cylinder part comprises a cylinder 24 which is of a known kind and is transparent and provided with visible graduations 26. Secure to the forward end of the cylinder 24 is a tubular spigot 28 to which can be removably applied a needle 30 as indicated in dotted lines.

Secured to the rearward end of the cylinder 24 is a screw-threaded ferrule 32 with which can be engaged a rear end closure cap 34 which is shown in Figure 1 as being on the piston part 22 but it should be appreciated that when the cylinder and piston parts are assembled the end cap 34 forms a part of the cylinder part 24.

The rear end cap 34 is formed with an annular recess 36 in which is located a spring 38 made of metal wire of circular cross-sectional shape as shown in Figure 4 and the spring comprises a part circular portion 40 as shown in Figure 6 of which the external diameter is substantially equal to the diameter of the annular recess 36 and said part-circular portion 40 extends over an angle greater than 180° so as to be located by the recess against transverse movement therein. The spring 38 is also provided with two arms 42 which extend inwardly of the part-circular portion 40 in a chord-like manner and these two arms are normally disposed parallel and equi-dis-

tantly on opposite sides of the centre of the part-circular portion 40 and the two arms are adapted to bear on a piston rod 44 hereinafter more particularly referred to of the piston part 22. The spring 38 is prevented from rotating relative to the end cap 34 about the axis thereof by two abutments 46 within the recess 36 and which may conveniently be formed by centre-punching a wall of the recess 36 at the two positions adjacent the arcuate corners formed by the junctions of the part-circular portion 40 and the two arms 42 of the spring 38.

The piston part 22 comprises the piston rod 44 which is formed at its forward end with a screw-threaded socket to receive a screw-threaded shank 48 of a piston head 50 which has fluid-tight slidable engagement with the bore of the cylinder 24 previously referred to.

Secured to the rear end of the piston rod 44 is a knob 52.

The piston rod 44 is made from metal rod of circular cross-sectional shape as shown in Figure 5 and the diameter of which is less than the diameter of the piston head 50.

The piston rod 44 is formed on two diametrically opposite sides thereof with parallel flats 54 and between said flats on one side of the piston rod with a line comprising a plurality of notches 56 separated by projections 58 and said flats and line of notches and projections extend longitudinally of the piston rod for a part of the length and between the ends thereof.

The notches are conveniently of right-angular cross-sectional shape as shown in Figure 4 and extend at right-angles to the longitudinal axis of the piston rod and the projections are formed with flat tops 60 as shown in Figure 4. The pitch of the notches 56 is equal along the entire line of notches and conveniently may be 0.048 inches which is equal to the distance between the graduations 26 on the cylinder 24 and conveniently each notch is of right-angular formation in cross-section and is of symmetrical V-shape relative to a transverse axis of the syringe or piston rod and the depth of each notch may be 0.015 inches and the diameter of the spring 38 may be 0.020 inches and the base of each notch may be 0.025 inches from the imaginary circumference of the piston rod.

By adjusting the angular position of the piston part 22 relative to the cylinder part 20 the two arms 42 of the spring 38 may be frictionally engaged with the two flats 54 to tend to hold the piston part in any required position longitudinally relative to the cylinder part, and the notches or projections constitute a tangible graduation means which can be felt by a patient so that when the piston part is moved relative to the cylinder part the relative distance moved and thus the dose drawn into the syringe or ejected therefrom can be accurately gauged by the patient counting the number of notches or projections which the piston rod

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part has moved relative to the rear end cap 34 of the cylinder part 20, this counting being achieved by the patient using his thumb nail to engage the notches 56.

5 Thus the dose is gauged solely by tangible graduation means.

In addition to gauging the dose by tangible graduation means audible graduation means can also be employed. The audible graduation means is provided by rotating the piston part 10 22 through an angle of 90° relative to the cylinder part 20 so that the line of notches 56 and projections 58 is engaged by one of the arms 42 of the spring 38 and the arrangement of the notches and the spring arm 42 15 is such that the spring non-prohibitively retains the piston part in a variety of positions longitudinally of the cylinder part 20 by said arm 42 engaging a recess 56 as shown in Figure 20 4 but movement of the piston part 22 into and out of the cylinder part 20 can be effected whereupon the arm 42 is caused to ride up either of the flanks of the notch 56 and across the flat top 60 to re-engage the next adjacent 25 notch 56 and this engagement occurs with a clicking noise whereby audible graduation means in the nature of a click-stop arrangement are provided to supplement the tangible graduation means previously referred to.

30 Referring to Figure 7 instead of the piston rod 44 being formed as one piece and with the notches and projections the piston rod comprises an inner rod (not shown) and a sleeve 62 made of metal and which may be 35 in the form of a split tube having a longitudinally extending split 64 or may be in the form of a plain i.e. an unsplit tube and this sleeve 62 is secured on the inner rod and is gripped between the piston head 50 and the knob 52 40 so as to become a rigid portion of the piston part.

Formed on diametrically opposite sides of the sleeve 62 are two lines 66 and 68 of notches and grooves each of which lines 45 extends longitudinally of the piston part and these notches and grooves may be formed by a pressing operation. The notches and projections in one line are equal in pitch to the pitch of the notches and projections in the other line 50 but the notches and projections in one line are staggered relative to the notches and projections in the other line so that a notch in one line is disposed in the same plane transversely of the piston part as a projection in the other 55 line. This arrangement may facilitate manufacture insofar that the pitch of the notches and projections in a line can be twice the pitch of the notches and projections shown in Figure 1 whilst, however, the effective distance 60 between graduations is the same in Figure 7 as in Figure 1 due to the fact that the two arms 42 will alternately engage recesses in the two lines 66 and 68.

Referring to Figure 8 a stop member sleeve 65 70 of predetermined length is mounted on the

piston rod 44, or the sleeve 62 as shown in Figure 7, and this stop member sleeve 70 constitutes a positive stop bar which co-operates at its one end with the piston head 50 and at its other end with the rear end cap 34. The stop member sleeve 70 is mounted on the piston rod prior to the piston head 50 being secured to the piston rod and stop member sleeves 70 of different lengths can be employed dependent upon the effective capacity required 75 of the syringe. It should be appreciated that the syringe may, in some circumstances, be used without the stop member sleeve 70.

The syringes previously described are of a non-disposable nature and Figure 9 illustrates 80 a piston part which is of a disposable nature. The piston part comprises a piston rod 44 having a piston head 50 at its forward end and a knob 52 at its rearward end and the piston rod 44 is of cruciform cross-sectional shape 85 to afford four longitudinally extending ribs 71, 72, 74 and 76 and different numbers of notches 78 and thus projections are formed along the edges of different ribs and for example forty equally spaced apart notches may be 90 provided on the rib 72, eight equally spaced notches are provided on the rib 74, four equally spaced notches are provided on the rib 76 and two equally spaced notches are provided 95 on the rib 71. The spacing apart of the various adjacent notches are such that, relative to dose units, two notches in the rib 71 correspond to twenty dose units, two notches in the rib 76 correspond to ten dose units, two notches 100 in the rib 74 correspond to five dose units and two notches in the rib 72 correspond to one dose unit. It should be appreciated that the provision of different numbers of notches on the different ribs facilitates the accurate gauging of the intake of the syringe by a blind 105 patient who can thus, therefore, gauge large, small and intermediate quantities quickly, easily and accurately by engaging his finger nail with the appropriate notches.

The piston part 22 illustrated in Figure 9 110 is preferably made as a plastics moulding with the exception of an annular piston head which is not shown in Figure 9 and which can be removably applied to a circular forward end of the piston rod which is provided with an 115 annular retaining groove 80 for the piston head indicated in dotted lines at 50.

Referring to Figure 10 the syringe illustrated includes a glass cylinder 24 and a glass piston part 22 of which a piston plunger 82 120 and the knob 52 are formed in one piece. The piston plunger 82 is formed with a line of notches and projections 56, 60 respectively which are engaged by a metal spring 84 which is in the form of a simple split ring and is 125 located in a slot 86 in one side of the cylinder and said notches, projections and spring 84 may be dimensioned as in Figure 4.

Referring to Figure 11 the cylinder 24, not the piston part 22 is provided externally with 130

a line of notches and projections 56, 60 and an indicator in the form of a spring limb 88 is secured at one end to the piston part 22 so as to move therewith and at its other end 90 either merely overlies the notches and projections so as to provide a tangible graduation means or in addition spring-engages the notches so that in addition audible graduation means are provided.

Instead of the line of notches and projections being formed on the cylinder 24 they may be provided on a bracket 92 secured to the rear end of the cylinder and the knob 52 forms an indicator and co-operates with the notches and projections to provide either a tangible graduation means or both tangible and audible graduation means.

When a syringe in accordance with any of the forms described and illustrated is to be used the piston part is fully inserted into the cylinder part and the piston part is withdrawn from the cylinder part the required number of notches or projections corresponding to the dosage intake required said number of notches or projections being the number of notches or projections which in Figure 1 for example are exposed beyond the end cap 34 and being engaged by the thumb nail of and counted by the patient so that an intake of air by the syringe is obtained equal to the required intake of a liquid from a bottle. The audible graduation means can also be employed as a safety precaution. The syringe needle is then inserted into the bottle and the air is fully exhaled into the bottle and the piston is then withdrawn the same number of notches or projections as previously and which are counted by the tangible graduation means with or without the audible graduation means and the position of the piston part relative to the cylinder part is maintained by the engagement of the spring 38 with the piston rod 44.

If it is necessary for a further liquid to be drawn into the syringe and a stop sleeve member 70 is incorporated into the syringe the piston part is withdrawn further to the full extent permitted by the positive stop member 70 to inhale air into the syringe. The syringe needle is then inserted into a further bottle of liquid and the piston part is pushed into the cylinder part until the patient's thumb nail which occupies the same notch as was previously engaged, abuts the end cap 34 indicating that all the air has been exhaled from the syringe and the piston part is then withdrawn for the full amount permitted by the stop member sleeve 70 whereby the syringe draws in the required additional quantity of further liquid to provide a total quantity of mixed liquid in the syringe.

The patient then self-injects this total quantity of liquid which has been accurately gauged.

The invention thus provides syringes of the kind specified or parts thereof which can be

used by a blind self-injecting patient such as for example a blind diabetic self-injecting patient, when injections of a mixture of two liquids containing insulin of different forms and which must be mixed in predetermined relative quantities are necessary but it should be appreciated that the syringes can be used by other blind self-injecting patients without reliance upon assistance by other persons.

#### WHAT I CLAIM IS:—

1. A syringe of the kind hereinbefore specified or a part therefor provided with tangible graduation means of which, at least when the syringe is in a partly or fully extended condition, a number is or are exposed which correspond to a dose of fluid drawn into or to be expelled from the syringe to enable a blind patient manually to assess the correct dose by counting the number of tangible exposed graduations.

2. A syringe or a part therefor according to Claim 1 and in which audible graduation means are incorporated.

3. A syringe or a part therefor according to Claim 1 or 2 wherein tangible graduation means are provided by a plurality of notches and projections which are spaced apart longitudinally of the syringe and correspond to doses.

4. A syringe or a part therefor according to Claim 3 wherein the notches and projections are provided on the piston part and can be exposed externally of and relative to the cylinder part to gauge the correct dose.

5. A syringe or a part therefor according to Claim 4 wherein the piston part comprises a piston rod and a piston head having fluid-tight sliding engagement with a bore of a cylinder of the cylinder part and the piston rod is of smaller cross-sectional area than the piston head and is provided with the notches and projections.

6. A syringe or a part therefor according to Claim 4 wherein the piston part comprises a piston rod and a piston head having fluid-tight sliding engagement with a bore of a cylinder of the cylinder part and the piston rod is of smaller cross-sectional area than the piston head and comprises an inner rod and a sleeve provided with the notches and projections and stationarily secured over said inner rod.

7. A syringe or a part therefor according to any of claims 3 to 6 wherein a plurality of lines of notches and projections are provided which are spaced apart transversely thereof.

8. A syringe or a part therefor according to claim 7 wherein the notches and projections in at least two lines thereof are equal in pitch but are relatively staggered longitudinally of the syringe.

9. A syringe or a part therefor according to claim 7 wherein the notches and projections in one line thereof are of one pitch and the notches and projections in another line thereof

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are of a different pitch.

10. A syringe or a part therefor according to claim 9 wherein the piston rod is formed with a plurality of longitudinally extending ribs and different lines of notches and projections are provided on the different ribs.
11. A syringe or a part therefor according to any of claims 1 to 3 wherein the notches and projections are provided on the cylinder part and an indicator which is movable with the piston co-operates with the notches and projections to indicate the dose of fluid.
12. A syringe or a part therefor according to any of claims 2 and 3 or claims 2 and 3 and any of claims 4 to 11 wherein a spring non-prohibitively co-operates with the notches and projections to afford the audible graduation means in the nature of a click stop arrangement.
13. A syringe or a part therefor according to claim 12 wherein the notches and projections are of symmetrical V-shape relative to a transverse axis of the syringe and the spring is of circular cross-sectional shape.
14. A syringe or a part therefor according to claim 12 or 13 when dependent on any of claims 5 to 11 wherein the spring is carried by the cylinder part in a manner preventing movement of the spring longitudinally and angularly relative to the cylinder part and the piston rod is provided with a longitudinally extending flat and the piston and cylinder parts can be relatively rotated so that the spring engages the line of notches and projections or the flat and serves to retain the piston part non-prohibitively in both its longitudinal and angular positions relative to the cylinder part.
15. A syringe or a part therefor according to claim 14 wherein the spring comprises a

pair of substantially parallel arms which are transversely spaced apart and engage diametrically opposite sides of the piston rod.

16. A syringe or a part therefor according to any of the preceding claims wherein a positive stop member is provided to co-operate between the piston and cylinder parts to permit the withdrawal of the piston part from the cylinder part a predetermined amount.
17. A syringe or a part therefor constructed substantially as described herein with reference to and as shown in Figures 1 to 6 of the accompanying drawings.
18. A syringe or a part therefor constructed substantially as described herein with reference to and as shown in Figure 7 of the accompanying drawings.
19. A syringe or a part therefor constructed substantially as described herein with reference to and as shown in Figure 8 of the accompanying drawings.
20. A syringe or a part therefor constructed substantially as described herein with reference to and as shown in Figure 9 of the accompanying drawings.
21. A syringe or a part therefor constructed substantially as described herein with reference to and as shown in Figure 10 of the accompanying drawings.
22. A syringe or a part therefor constructed substantially as described herein with reference to and as shown in Figure 11 of the accompanying drawings.

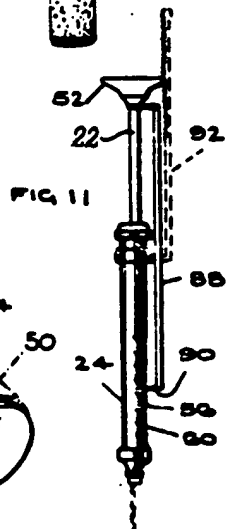
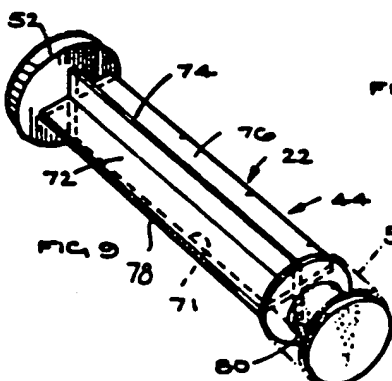
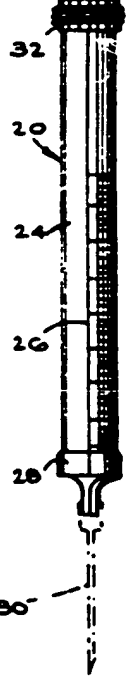
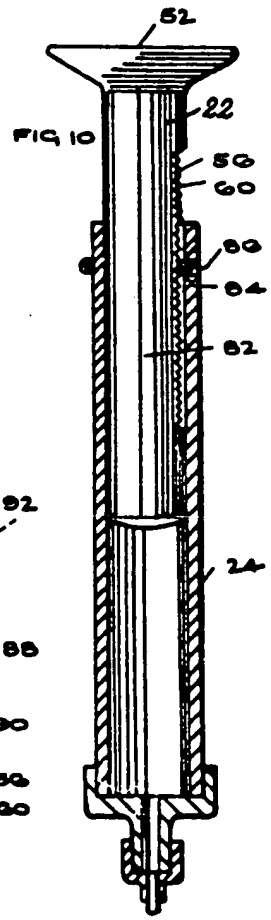
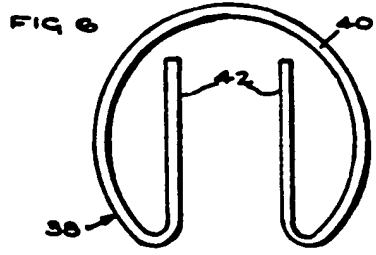
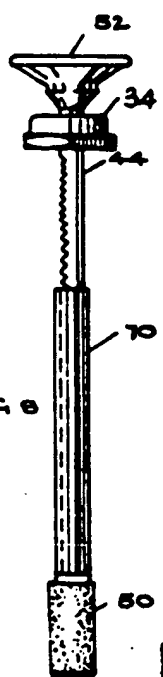
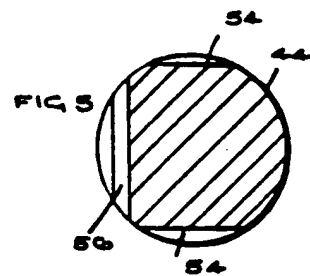
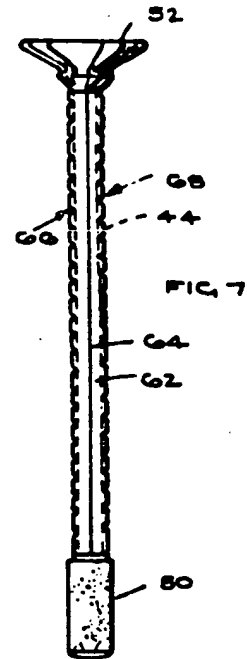
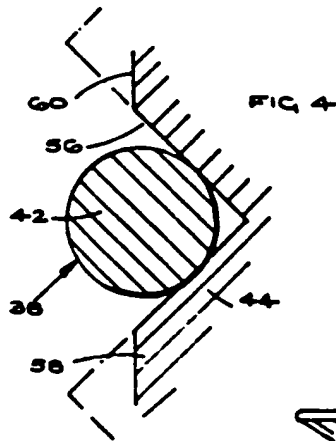
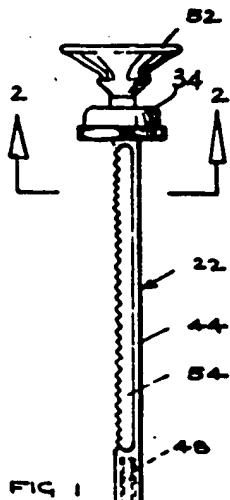
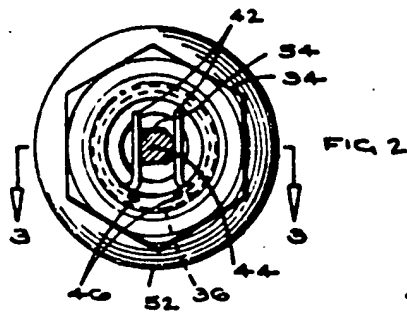
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